

Biodiversity Domain and Drug Development : Issues and Views

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n internet search for "Definition of biodiversity" yields around 2,450,000 results L clearly indicating that all over the world, the scope, meaning and ease of expression of the word "biodiversity" is dependent on the application domain. The word "Biodiversity" generally refers to "Biotically diverse" or relative abundance and variety of plant and animal species and ecosystems within particular habitats <www.greatlakesbioenergy.org/ research/bioenergy-glossary/> and is often used as a measure of the health of biological systems or the variation of life forms within a given ecosystem, biome or the diversity (number and variety of species) of plant and animal life within a region for the entire earth <en.wikipedia.org/wiki/Biodiversity>. The diversity of plant and animal life in a particular habitat (or in the world as a whole); "a high level of biodiversity is desirable for the sustenance of the mankind" <wordnetweb.princeton.edu/perl/ webwn>. The 1992 United Nations Earth Summit in Rio de Janeiro defined "biodiversity" as "the variability among living organisms from all sources, including, 'inter alia', terrestrial, marine, and other aquatic ecosystems, and the ecological complexes of which they are part : this includes diversity within species (genetics), between species and of ecosystems".

The ecosystem of mother nature is a very delicate fabric. We have to recognize its importance and strive to conserve/protect and support it through our rich societal values, excellence in performance, networking, communication and engagement approaches or we should be ready for a dooms day for the mankind. Biodiversity found on Earth today is the result of 4 billion years of evolution. The origin of life is not well known to science, though limited evidence suggests that life may already have been wellestablished only a few 100 million years after the formation of the Earth. Until approximately 600 million years ago, all life consisted of bacteria and similar single-celled organisms. The apparent biodiversity shown in the fossil record suggests that the last few million years include the period of greatest biodiversity in the Earth's history. Estimates of the present global macroscopic species diversity vary from 2 million to 100 million species, with a best estimate of somewhere near 10 million. It has been argued that the present rate of extinction is sufficient to create a major mass extinction in less than 100 years.

The roles of biodiversity

- Ecological role of biodiversity: All species provide at least one function in an ecosystem. Each function is an integral part of regulating the species balance, species diversity and species health: all aspects which are intrinsic for the ecosystem as a whole to survive and prosper.
- Ecosystems also provide various infrastructure of production (soil fertility, pollinators of plants, predators, decomposition of wastes) and services such as purification of the air and water, stabilisation and moderation of the climate, decrease of flooding, drought, and other environmental disasters. Research suggests that a more diverse ecosystem is better able to withstand environmental stress and consequently is more productive.
- **Economic role of biodiversity**: For all humans,

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biodiversity is a resource for daily life. One element of biodiversity is crop diversity. Many see biodiversity as a reservoir of resources to be drawn upon for the manufacture of food, pharmaceutical, and cosmetic products. This concept of biological resources management probably explains most fears of resource disappearance related to erosion of biodiversity. However, it is also the origin of new conflicts dealing with rules of division and appropriation of natural resources.

Levels of biodiversity

Thus, biodiversity is the variety of life: the different plants, animals and micro-organisms, their genes and the ecosystems of which they are a part. Understanding the "hierarchical nature of nature" is essential for understanding its functioning and dynamics. Diversity exists and can be measured at the level of the molecule, gene, individuals, species, populations, communities, ecosystems, landscapes and regions. Therefore, biodiversity is generally viewed as three levels consisting of genetic, species, and ecosystem diversity.

Genetic diversity refers to the variety of genetic information in all organisms. Genetic diversity is the sum of genetic information contained in the genes of individual plants, animals, and micro-organisms. Each species consists of many organisms and virtually no two members of the same species are genetically identical. Species consist of individuals, and group of individuals of the same species populating a given area constitute a population. In general, the within species biological variation consists of genetic variation and diversity of phenotypes it creates. Genetic variation within a species means the difference in genotypes of individual specimens of a species. Genotype is the genetic constitution of an organism. The individuals of a species carry different genes, each individual representing a unique set of genes. Genotype codes for the phenotype of a species consists of the observable attributes of an organism like the body size or weight, shape of leaves etc. The phenotype of an individual plant or animal is determined to some extent by its genotype, but also influenced by the environment in which it exists. The interaction between genotype and phenotype has often been described using this equation:

Genotype + Environment + Randomvariation = Phenotype

At ecosystem level, it relates to the variety of the communities, ecological processes and the diversity of habitats occuring within each ecosystem type. The ecosystems, habitats and communities present difference in species diversity. It is measured by species richness -number of species in a defined area or region- and species abundance (sample relative numbers among species). Biodiversity can be also described by the richness of other taxonomic groups, higher than species, like families or orders.

There is a need to study endangered, at risk and extinct species of the world and analyse what we lost. As of 2010 there have been numerous cases where genetic material unique to a given species has been utilized in developing a disease cure or producing a biochemical that is instrumental in medical research beneficial to humans. If genetic materials are lost through the present Holocene extinction event numerous medical cures will be foreclosed and lost forever.

Thus from the plant biodiversity point of view, all above play a very significant role in establishing the medicinal properties of plants which are synthesized by them for their use.

Biodiversity as a source for drug discovery: A loss in biodiversity of a region directly affects the medicinal plants and their population in the region, thereby a loss of potent bioactive molecules. The drug discovery process is very much dependent on the biodiversity for their medicinal properties. More richer is the biodiversity, greater are the chances to discover newer bioactive molecules which a species synthesises/produces to safe guard itself from environmental as well as other biota - be it terrestrial or marine biota .

If a bio-resource is renewable then it becomes a source for procuring those bioactive molecules otherwise bioactive molecules/candidate drugs are isolated and purified from natural resources and



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subjected to synthesis of the molecules in a range of chemical library. These molecules are subjected to screening in test models standardised for various disease conditions and then if found active then toxicological studies are conducted. In case found safe then molecules are subjected to clinical trials against the disease condition as per the property of the molecule(s). A total of 9-16- years are consumed in establishing the status of a candidate drug as a drug.

We have to save the biodiversity for the over all betterment of the mankind and for its sustenance and health. As evident from the table a number of potent bioactive molecules are yet to be discovered from the biodiversity

Need of the time

- 1. Formulate a unified biodiversity law for the country, chart out country specific Good Biodiversity Processes and implement them strictly with provisions of stringent punishment of the culprits including natural resource mafia for conservation, protection and enhancement of biodiversity.
- 2. Herbal exports whether national or International should be banned totally. Websites selling natural resources should be asked to put back 50% of their earnings in reinforcement of consumed bioresource in a planned manner so as to halt the loss of biodiversity and continue to reverse previous losses through targeted action for species and habitats.
- 3. Top priority to development of district wise, state wise database on the biodiversity of the country for bio-resource prospecting, as well as preservation of biota in germplasm banks and gene banks.
- 4. Commissioning of Central Biodiversity Regulatory Authority for natural biological resources to bring to line collectors/retailers/ users/industry (Pharmaceuticals, timber) of biota.
- 5. Plan and execute employment programs for populations in and around forest to save biodiversity and minimize their dependence on

forests for their livelihood. Thereby minimizing the damage to the natural resources.

- 6. General awareness programs should be conducted to educate masses about our natural heritage; reasons and ways to preserve it
- 7. Mining activity in and around forest areas should be minimized Export of Natural Biological resources should be banned in all forms and shape.
- 8. Extensive use of Remote sensing in bioprospecting on a regular basis
- 9. Inclusion of Biodiversity as a subject at school and college levels, A field teaching position in every school/college.
- 10. Design & development of biodiversity portals; particularly for children as a policy under compulsory education program. Development of e-books, animations, video films, videogames oriented towards the preservation of biodiversity for children, with knowledge about endangered species, red list species etc
- 11. Encouragement to projects related to biodiversity conservation, protection, creation of new zonal national parks, which can help protect the region specific biodiversity for the future.
- 12. Establishment of Centre of Excellence in Geographical-Biodiversity studies, in specialized subject areas like systematic, ethno-botany, ethnopharmacology and plant bioinformatics including verification of ethno-medicinal claims of various flora and fauna, systematic harnessing of rich treasures of bio-resources for the development, sequencing of medicinal flora and fauna for in-silico prediction of medicinal properties, legend designing etc., for the better health care of mankind and of the mother earth as a whole.

Acknowledgements

The author is thankful to Dr. T. K. Chakraborty, Director, Central Drug research Institute, Lucknow for his kind approval, encouragement, suggestions and critical evaluation of the article.